Name:____________________________________ Date:____________________

Polynomial Operations SOLUTION (version 125)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = 8x^5 + 10x^4 + x^2 - 7x - 9$$

$$q(x) = -10x^5 - 7x^4 - 5x^3 - 8x^2 - 1$$

Express the difference $p(x) - q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) - q(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (8)x^5 + (10)x^4 + (0)x^3 + (1)x^2 + (-7)x^1 + (-9)x^0 \\ q(x) &= (-10)x^5 + (-7)x^4 + (-5)x^3 + (-8)x^2 + (0)x^1 + (-1)x^0 \\ p(x) - q(x) &= (18)x^5 + (17)x^4 + (5)x^3 + (9)x^2 + (-7)x^1 + (-8)x^0 \\ p(x) - q(x) &= 18x^5 + 17x^4 + 5x^3 + 9x^2 - 7x - 8 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 5x^2 + 3x + 6$$

$$b(x) = -2x - 3$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$5x^2$	$3x$	6
$-2x$	$-10x^3$	$-6x^2$	$-12x$
-3	$-15x^2$	$-9x$	-18

$$a(x) \cdot b(x) = -10x^3 - 6x^2 - 15x^2 - 12x - 9x - 18$$

Combine like terms.

$$a(x) \cdot b(x) = -10x^3 - 21x^2 - 21x - 18$$

3. Express $(x+1)^4$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^4 + 4x^3 + 6x^2 + 4x + 1$$

Polynomial Operations SOLUTION (version 125)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 2x^3 + 17x^2 + 9x + 15 \\ g(x) &= x + 8 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+8}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 2 & 17 & 9 & 15 \\ \text{-8} & & \text{-16} & \text{-8} & \text{-8} \\ \hline & 2 & 1 & 1 & 7 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = 2x^2 + x + 1 + \frac{7}{x+8}$$

In other words, $h(x) = 2x^2 + x + 1$ and the remainder is $R = 7$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 2x^3 + 17x^2 + 9x + 15$. Evaluate $f(-8)$.

You could do this the hard way.

$$\begin{aligned} f(-8) &= (2)\cdot(-8)^3 \;+\; (17)\cdot(-8)^2 \;+\; (9)\cdot(-8) \;+\; (15) \\ &= (2)\cdot(-512) \;+\; (17)\cdot(64) \;+\; (9)\cdot(-8) \;+\; (15) \\ &= (-1024) \;+\; (1088) \;+\; (-72) \;+\; (15) \\ &= 7 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-8)$ equals the remainder when $f(x)$ is divided by $x + 8$. Thus, $f(-8) = 7$.